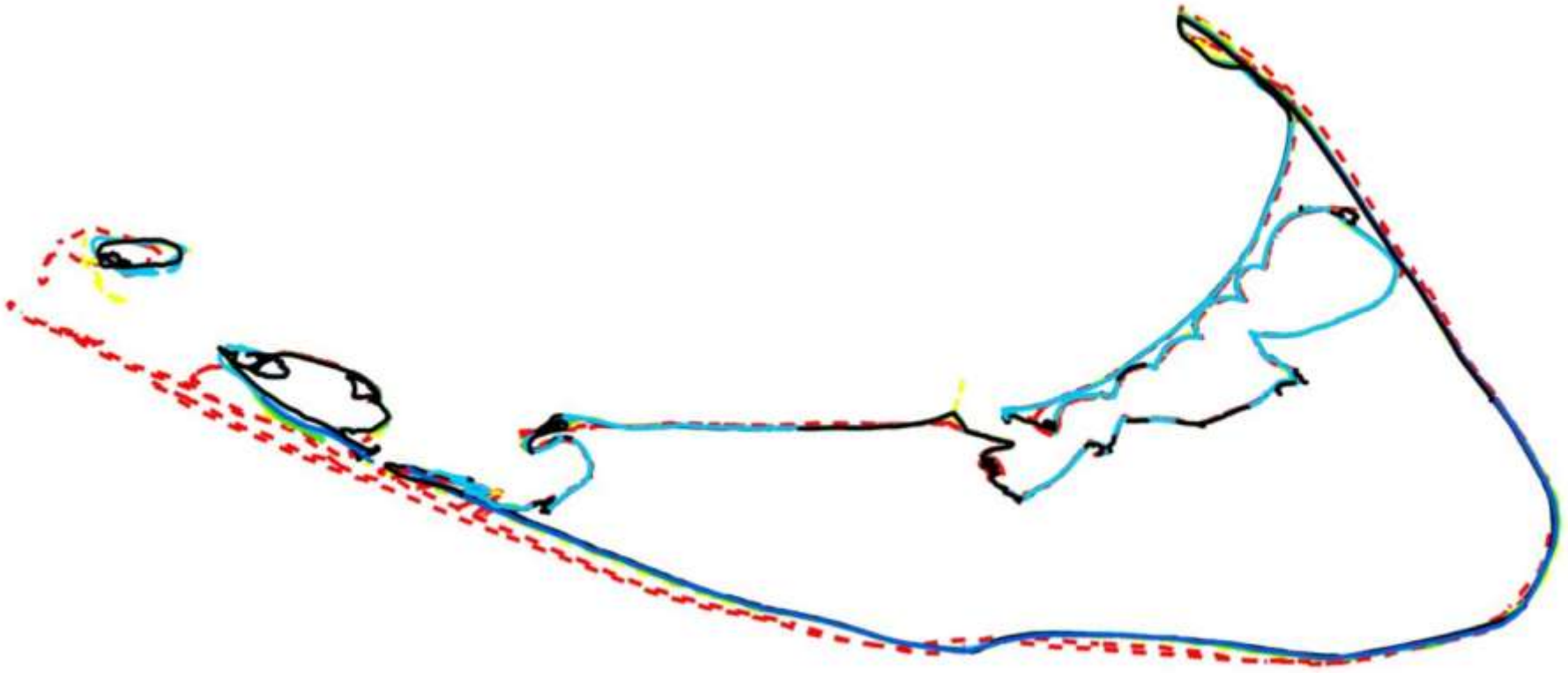
Shoreline Change Around Nantucket



Julia Knisel

Coastal Shoreline and Floodplain Manager

MA Office of Coastal Zone Management

Natural Process

- Shoreline positions fluctuate (seasons & storms)
- Dunes & banks erode & supply beaches with sand

Issue: Coastal Property Damages

- Development is susceptible to risks from winds, waves, storm surge, flooding, sea level rise *& associated erosion*

Issue: Public Health and Safety

- Erosion can expose septic systems & sewer pipes, contaminating shellfish beds & other resources

Issue: Coastal Engineering Impact

- Seawalls & other shoreline stabilization structures *often* increase erosion along adjacent properties

Coastal Management Challenge

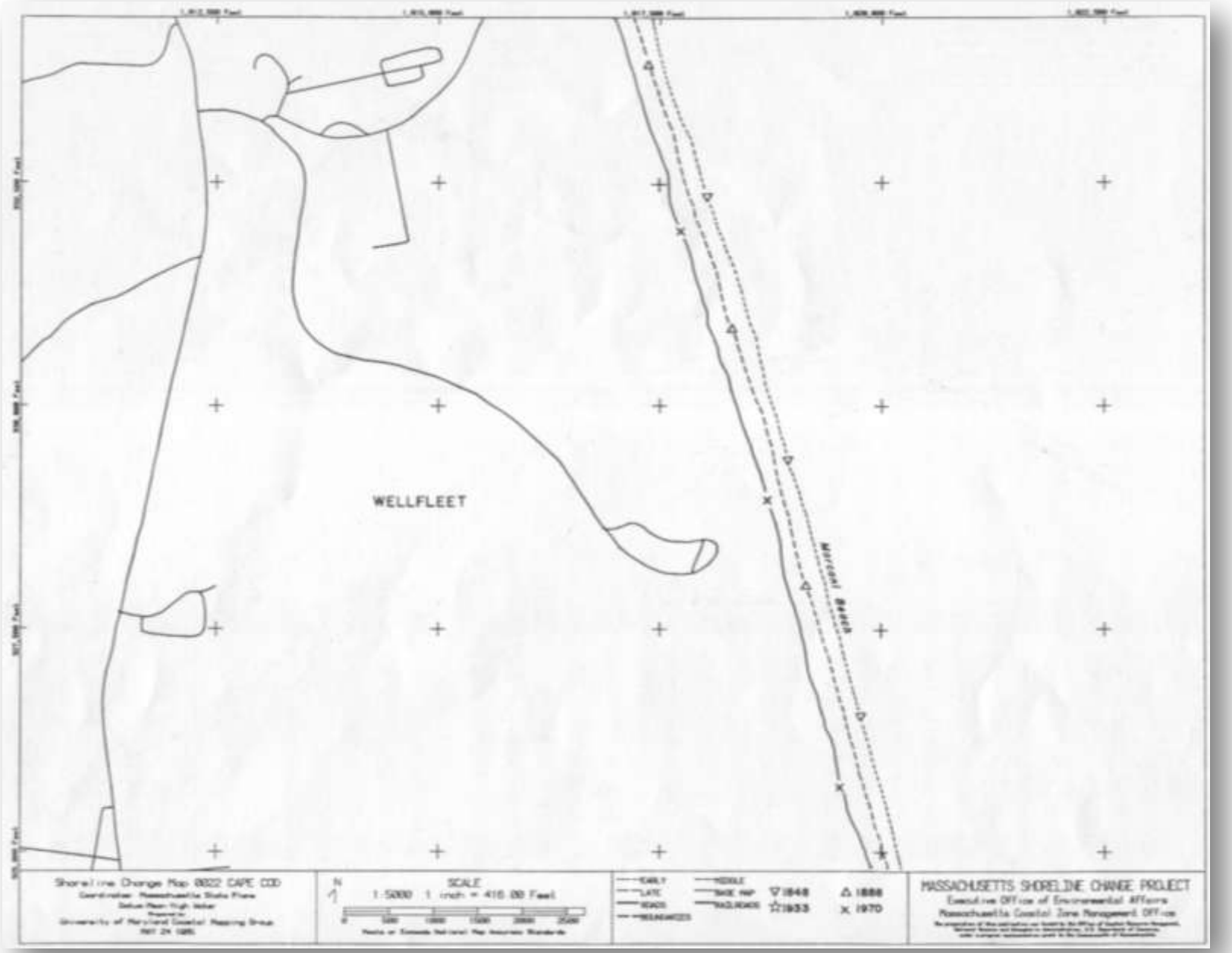
- Understand & work with erosion – not against it
- Site new development in a manner that accommodates shifting conditions

- Modify existing development
- Add sediment to beach systems

Shoreline Position?

- Mean high water elevation
- High tide line seaward of storm debris wrack line: tonal change between wet & dry beach material, or a seaweed/debris line
- Algal line on rocky outcrops: tonal change between wet surfaces that host algae & dry surfaces with no algae
- Vegetation change between *Spartina patens* in upper marsh & *Spartina alterniflora* in lower marsh, or outer limits of emergent marsh vegetation
- Interface between vertical seawalls/bulkheads & water

1989 Shoreline Change Maps



2001 Shoreline Change Browser

Mass.Gov · get things done · agencies · elected officials · help

Find Shoreline Changes

Enter the Transect Number: Search

Choose a Place

View Legend

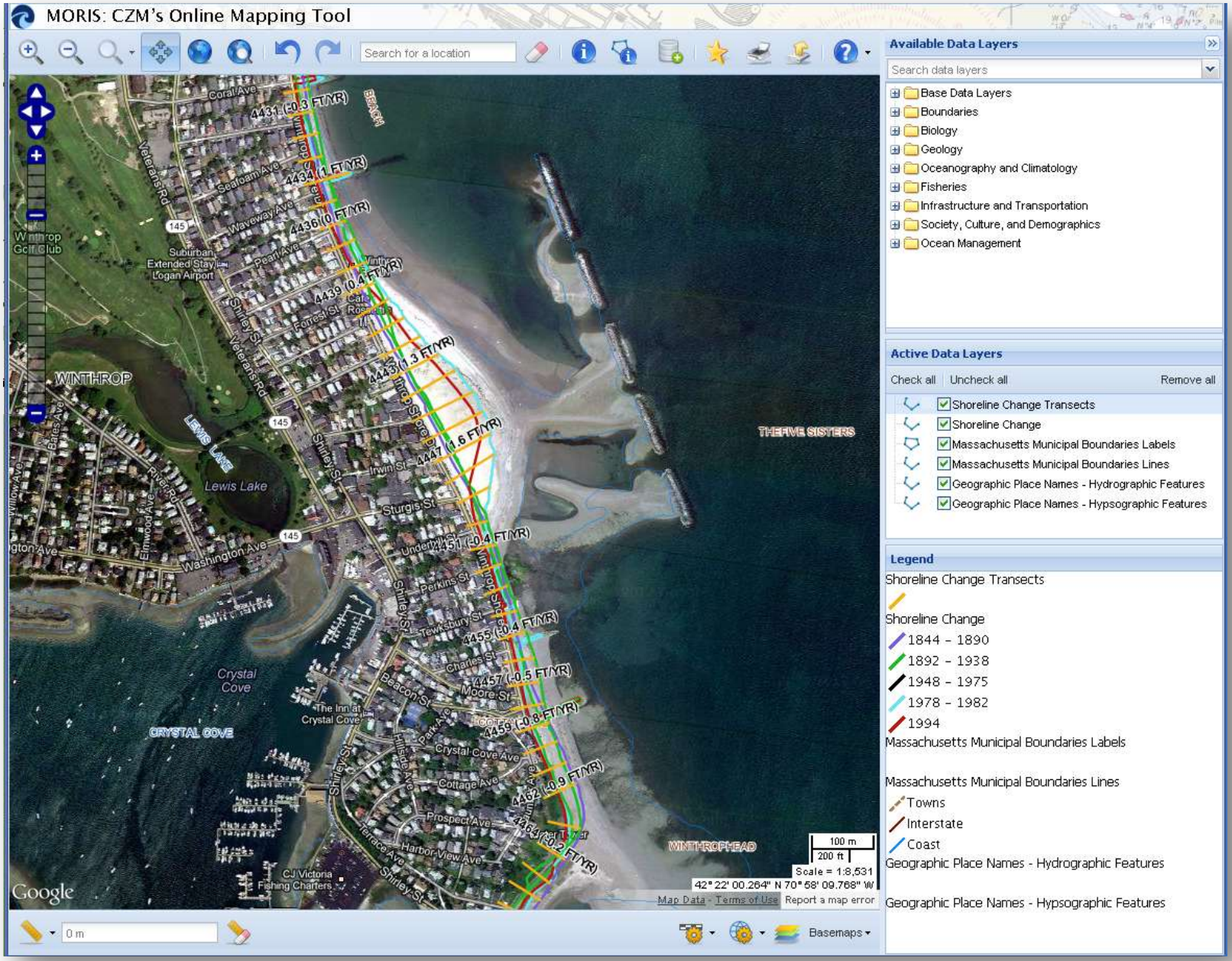
Important Data Information

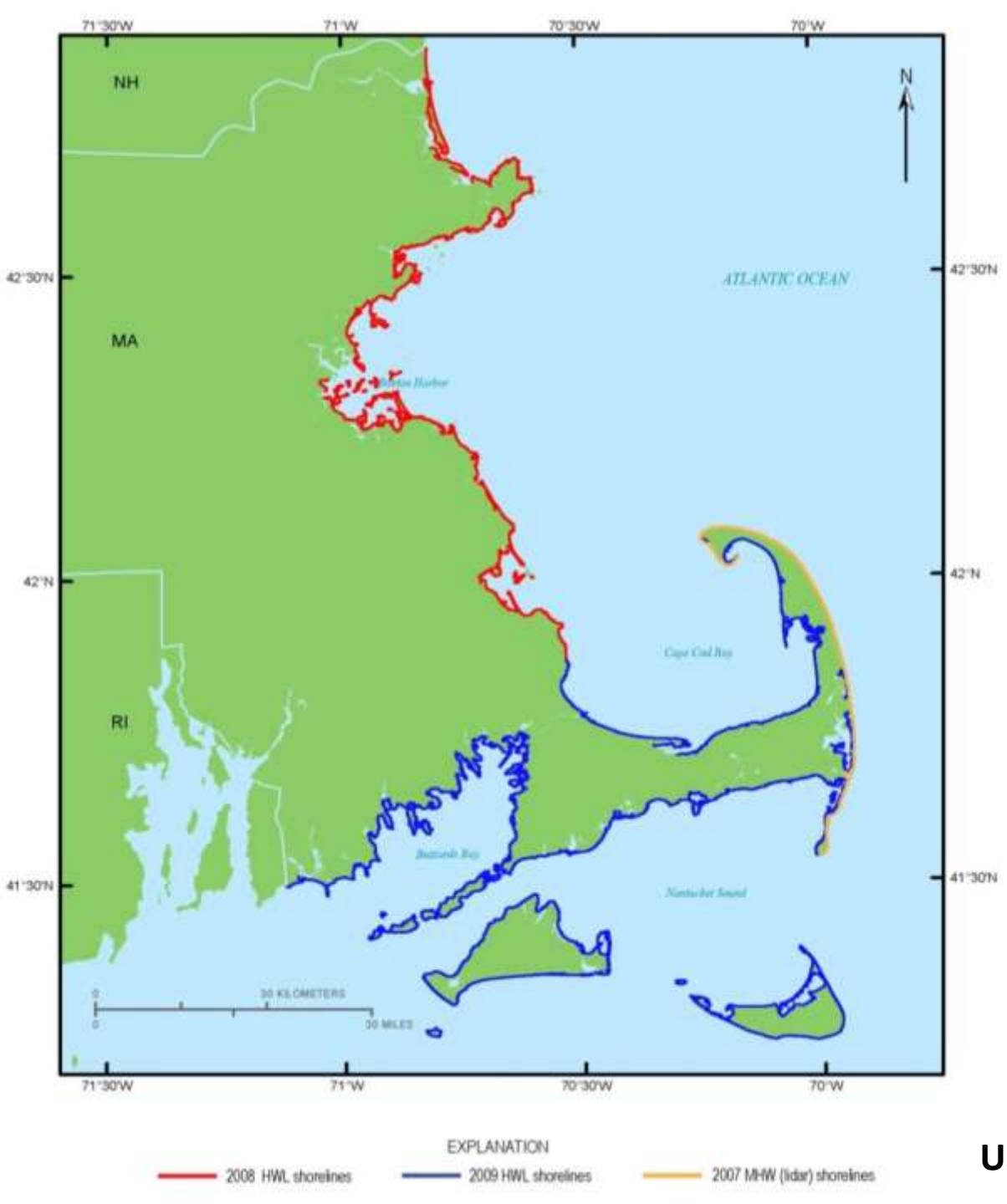
SANDWICH, MA

Transects

Transect Number:	9182
First Time Period:	07/1909-07/1952
Change(Ft)First Time Period:	202.8867
Rate(Ft/yr)First Time Period:	4.7244
Second Time Period:	07/1952-07/1978
Change(Ft)Second Time Period:	77.6573
Rate(Ft/yr)Second Time Period:	2.9856
Third Time Period:	07/1978-07/1994
Change(Ft)Third Time Period:	9.8425
Rate(Ft/yr)Third Time Period:	0.6234
Fourth Time Period:	
Change(Ft)Fourth Time Period:	0
Rate(Ft/yr)Fourth Time Period:	0
Long Term Shoreline Change Rate (this is calculated using linear regression)(Ft/yr):	3.54

Shoreline Change in MORIS





Update

- USGS delineated spring 2007, 2008 & 2009
- ~ 26,000 transects along 1,100 miles
- Updated rates from 1800s to 2009

USGS
science for a changing world

USGS draft Open-File Report, 2013

2007-2009 Shoreline Indicators

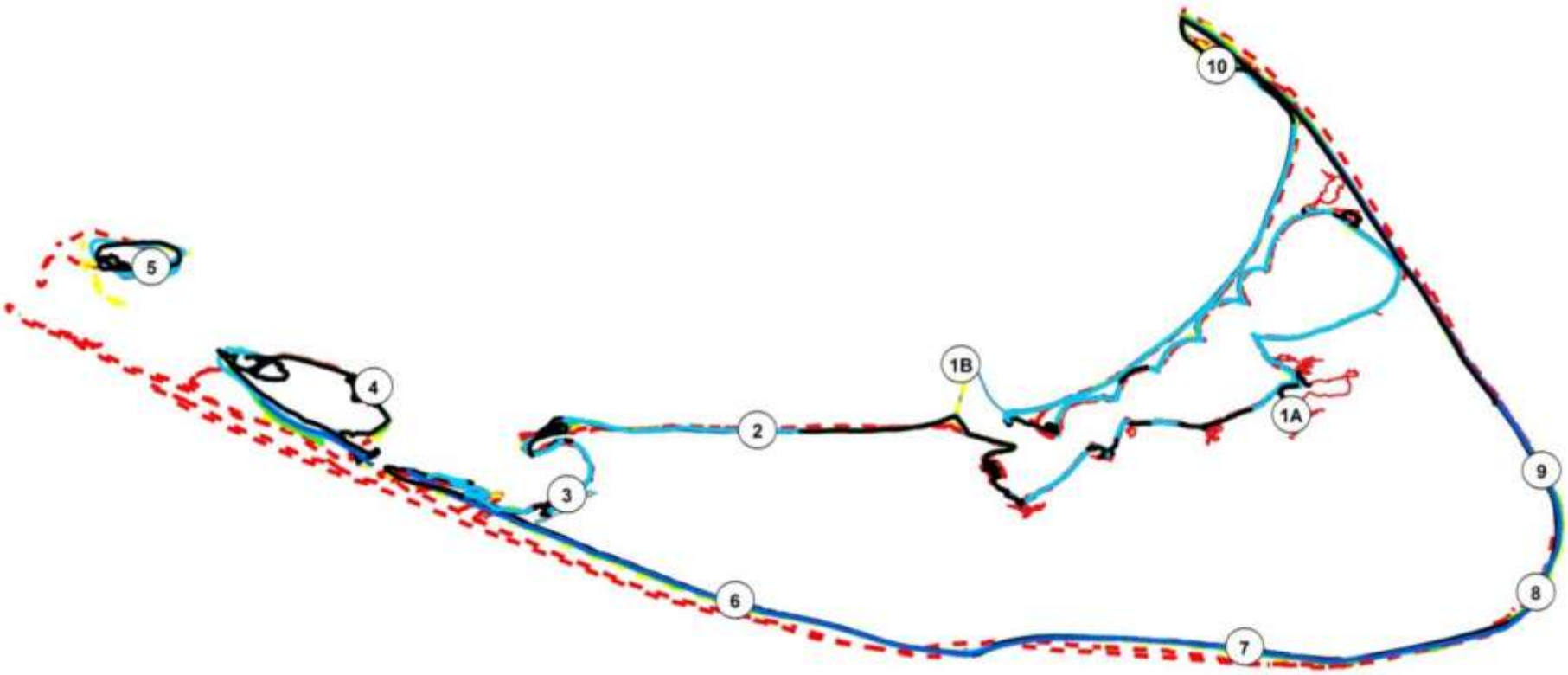
Region	High Water Line (miles)	LIDAR Mean High Water Line (miles)	Marsh High Water Line (miles)	Coastal Structures (miles)
North Shore	106	0	16	48
Greater Boston	28	0	6	18
South Shore	85	0	24	22
Cape Cod Bay	86	0	31	9
Outer Cape Cod	30	53	19	1
Cape Cod South	62	0	2	17
Buzzards Bay	144	0	40	38
Elizabeth Islands	57	0	1	1
Martha's Vineyard	83	0	4	5
Nantucket	81	0	4	1
State total	**762**	**53**	**146**	**160**

USGS draft Open-File Report, 2013

Shoreline Sources & Uncertainties

- **1844-1897**: topographic sheets (~ 38’)
- **1909-1938**: topographic sheets (~ 38’)
- **1943-1969**: topographic sheets (~ 22-38’)
- **1970-1982**: topographic sheets & aerial photos (~ 22’)
- **1994**: aerial photos (~ 22’)
- **2000**: LIDAR (~ 4’)
- **2001**: orthophotos (~ 17’)
- **2007-2009**: LIDAR & orthophotos (~ 4-20’)

Sector Long-Term Trends



Sector	1A	1B	2	3	4	5	6	7	8	9	10
Max. Erosion (ft/yr)	-4.82		-2.69	-8.50	-22.67	-23.46	-12.63	-9.22		-1.61	-7.94
Max. Accretion (ft/yr)	11.32	7.12	7.19	2.10	0.95	14.04	5.22	3.77	4.30		9.88

Erosion Dominated

- Long-term erosional trend at red transects

Sector 1B Stable

Sector 8 Stable

Sector 6 Erosional

Interpretation

- **Consider all available information:**
  - long-term & short-term shoreline change data
  - shoreline position: seasonal trends & storms
  - rate uncertainty (+/-)
  - management history: coastal structures & nourishment
  - current site conditions: dry beach width & vegetation
  - recent changes in shoreline uses: development
  - other alterations to natural shoreline processes

Application

- **Project siting & design**: buildings & infrastructure
- **Project review**: all boards
- **Land management**: restoration & acquisition
- **Hazard mitigation planning**: vulnerability assessments
- **Identification of other hazards**: flooding & sea level rise

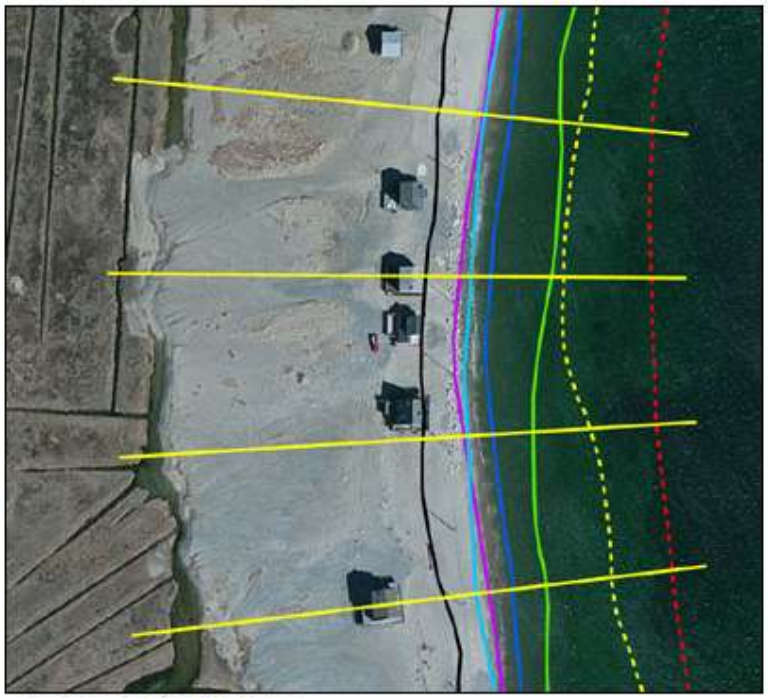
For More Information

www.mass.gov/czm/hazards/shoreline_change/shorelinechangeproject.htm

Massachusetts Shoreline Change Project

To help make informed decisions, coastal managers, shorefront landowners, and potential property buyers need information on shoreline trends, including erosion and accretion rates. The goal of the Massachusetts Office of Coastal Zone Management (CZM) Shoreline Change Project is to develop and distribute scientific data that will support local land-use decisions.

CZM's Shoreline Change Project illustrates how the shoreline of Massachusetts has shifted between the mid-1800s and 2009. Using data from historical and modern sources, up to eight shorelines depicting the local high water line (i.e., the landward limit of wave runup at the time of local high tide) have been generated with transects at 50-meter (approximately 164-feet) intervals along the ocean-facing shore. For each of these more than 26,000 transects, data are provided on net distances of shoreline movement, shoreline change rates, and uncertainty values. CZM has incorporated these shoreline change data into MORIS, the Massachusetts Ocean Resource Information System, and a customized MORIS shoreline change browser. Both of these web-based mapping tools can be readily accessed by the public.

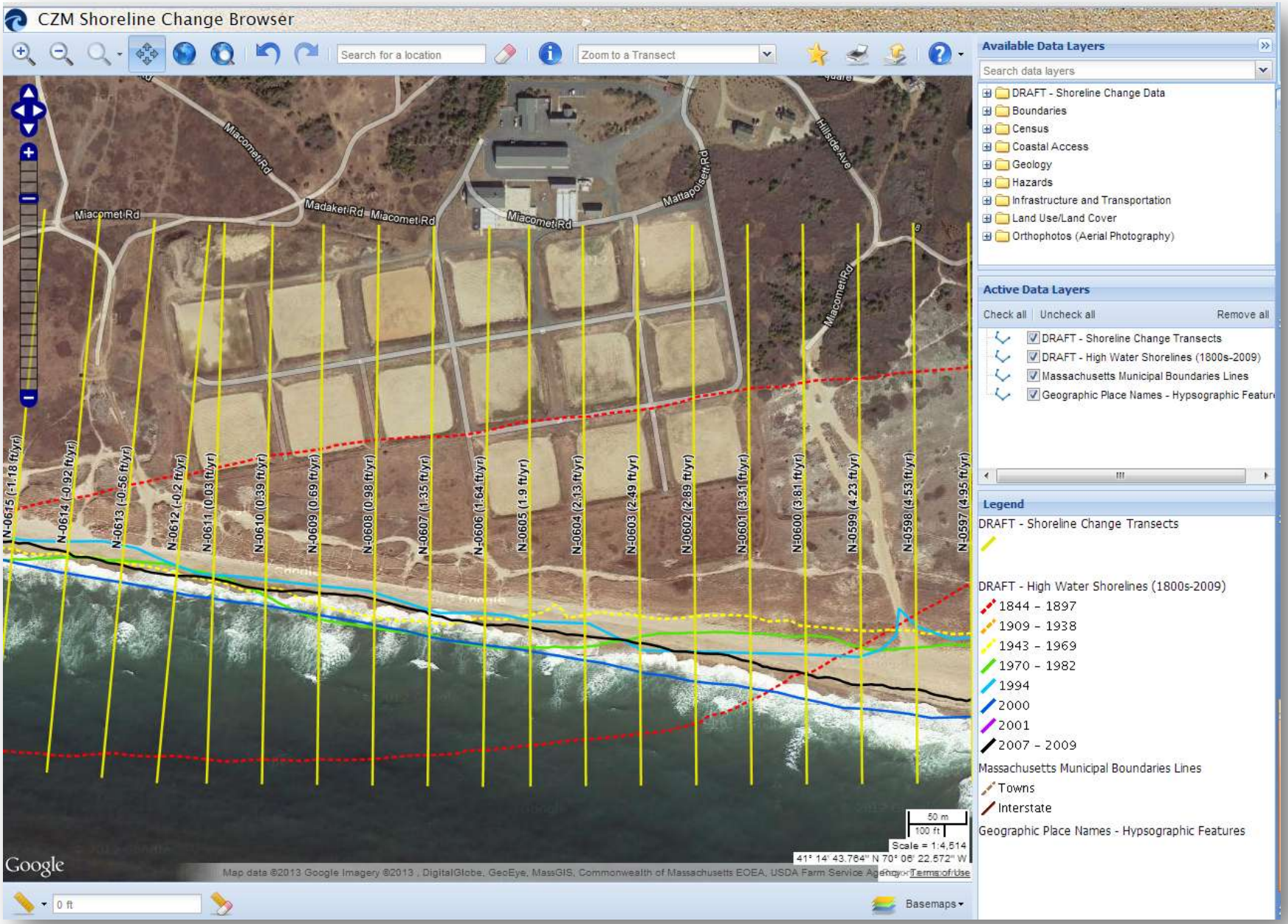


Shorelines with Transects

Please read the following before viewing the interactive shoreline change browser: Coastal shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variation, human alteration, and other factors that influence the movement of sand and other material within a shoreline system. The loss (erosion) and gain (accretion) of coastal land is a visible result of the way shorelines are reshaped in the face of these dynamic conditions. The information below explains the process of shoreline change, discusses its impacts, summarizes the Shoreline Change Project, and explains how to interpret and apply the shoreline change data.

A word of caution to shorefront landowners, potential buyers, and others interested in this information as it relates to a particular property: The Shoreline Change Project presents both long-term (approximately 150-year) and short-term (approximately 30-year) shoreline change rates at 50-meter intervals along ocean-facing sections of the Massachusetts coast. In a broad sense, this information provides useful insight into the historical migration of Massachusetts shorelines and erosional hot spots. Care must be used, however, when applying this information to a specific property or section of coastline. Due to the multitude of natural and human-induced factors that influence shoreline positions over time, correct interpretation of the data requires knowledge of coastal geology and mapping and the other forces that affect shorelines. CZM recommends consulting with a professional when applying the Shoreline Change Project data for land-use decisions and planning purposes. In no case should the long-term shoreline change rate be used exclusively before the short-term rate, uncertainty associated with each shoreline position, patterns of erosion and accretion, and other contributing factors are understood and assessed.

maps.massgis.state.ma.us/map_ol/czm_shorelines.php



csc.noaa.gov/digitalcoast/tools/slrviewer

DIGITAL COAST
NOAA Coastal Services Center

Home About Data Tools Tr

Tools

Sea Level Rise and Coastal Flooding Impacts Viewer

NOAA Coastal Services Center

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Overview

View the current status of the tool.

Being able to visualize potential impacts from sea level rise is a powerful teaching and planning tool, and the Sea Level Rise Viewer brings this capability to coastal communities. A slider bar is used to show how various levels of sea level rise will impact coastal communities. Completed areas include Mississippi, Alabama, Texas, Florida, and Georgia, with additional coastal counties to be added in the near future. Visuals and the accompanying data and information cover sea level rise inundation, uncertainty, flood frequency, marsh impacts, and socioeconomics.

Contacts

- **Shoreline Change Project**: Julia Knisel at julia.knisel@state.ma.us or Rebecca Haney at rebecca.haney@state.ma.us
- **MORIS**: Dan Sampson at daniel.sampson@state.ma.us
- **Regional Context**: Steve McKenna at stephen.mckenna@state.ma.us
- **Other Support**: Greg Berman at gberman@whoi.edu

CZM
Massachusetts Office of Coastal Zone Management

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